



Lorg Wind Farm
Technical Appendix 11D

Bat Survey Report





Report for

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1. Introduction

1.1 Background and purpose of this report

- 1.1.1 WSP E&I Solutions UK Ltd (formerly Wood Group UK Ltd) was commissioned by RWE Renewables UK Developments Ltd to undertake survey work in relation to bats at the proposed Lorg Wind Farm (herein after referred to as ‘the Site’ or ‘the Proposed Development’).
- 1.1.2 The Site is located approximately 11 kilometres (km) north-east of Carsphairn and 10.5 km south of New Cumnock; within the administrative boundary of Dumfries and Galloway and East Ayrshire Councils. It has a central Ordnance Survey [OS] Grid Reference at NS 66841 00661.
- 1.1.3 The principal components of the Proposed Development would comprise: 15 turbines; associated hardstanding areas; access tracks; two anemometer masts; interconnecting cables between turbines and ancillary connecting infrastructure elements.. Temporary development areas will also be required in order to facilitate a construction e.g. two construction compounds, a gatehouse and up to two borrow pits.
- 1.1.4 All British bat species are protected under UK and European legislation (see **Appendix A**), such that it is a criminal offence to disturb, injure or kill any bat, or damage or destroy a bat roost (even when no bats are present). In order to comply with the relevant legislation and policy it is therefore necessary to understand how bats are using ecological features within the Site so that the potential impacts on the bat population as a result of the Proposed Development can be appropriately assessed and, if necessary, mitigated.
- 1.1.5 This report details the following elements:
- The methods employed to survey bat activity on the Site;
 - The results of the surveys,
 - A summary of key findings as they relating to bat activity; and
 - An evaluation of the potential risk to each species.
- 1.1.6 The data and assessment as contained in this report may be used to inform an assessment of the ecological effects of the Proposed Development. They will be referenced in the Environmental Impact Assessment Report (EIAR) and, in turn, should inform master planning and mitigation design.

1.2 Site and Study Area Description

- 1.2.1 The Site is located at the northern end of a 10km-long single-track road leading off from the B729 (**Figure 1.1**). Landscape within the Site is defined by steep hillslopes of Ewe Hill, Lorg Hill, Alwhat, and Alhang Hill to the north-west, and Altry Hill to the south-east. Lorg Farmhouse, an unoccupied stone building, is positioned at the base of a steep sided valley in the centre of the Site. Elevation within the Site ranges from approximately 280 metres (m) Above Ordnance Datum (AOD) at the base of the valley to 642 m AOD at the summit of Alhang.
- 1.2.2 Several watercourses flow through the Site, which eventually join the Water of Ken. The Water of Ken intersects the centre of Site, flowing in a north-east to south-west direction.

- 1.2.3 The 'Study Area' was defined by the proposed wind farm layout at the time of the survey and incorporates all land within the red-line Site boundary (**Figure 1.1**).

2. Methodology

2.1 Good practice guidelines

- 2.1.1 A variety of survey methods have been employed to assess the use of the Study Area by bats, in line with good practice guidelines and interpreted using professional experience. The Bat Conservation Trust's (BCT) Good Practice Guidelines (Collins, 2016) and NatureScots's (NS) Bats and Onshore Wind Turbines guidance (NS, 2021) were the main source of guidance considered when designing the survey methodology and programme of survey work.

2.2 Desk study

Data search

- 2.2.1 To inform the survey design and provide context for assessment, records of bat roosts and bat activity within 15km of the Site boundary were requested from the South West Scotland Environmental Information Centre (SWSEIC).
- 2.2.2 A search for sites designated for the purpose of bat conservation within an approximate 10km radius of the Site boundary was also carried out through use of the NatureScot Sitelink web-based application¹.
- 2.2.3 Aerial imagery (from Google Maps and Google Earth) and Ordnance Survey maps were also reviewed to identify landscape and habitat features that may influence how bats utilise the Study Area.

Previous survey work

- 2.2.4 The Lorg Wind Farm Environmental Statement (ES) (the 2015 ES) (Amec Foster Wheeler, 2015) detailed the results of bat survey work carried out at the Site between 2012 and 2013. The 2015 ES was reviewed to provide contextual information about the Study Area.

2.3 Field survey

Habitat assessment

- 2.3.1 The potential suitability of habitats and features present within the Study Area to support foraging and commuting bats was assessed with reference to the previous survey results as detailed within the 2015 ES. The results were updated in 2020 and evaluated based on the criteria summarised in **Table 2.1** (Collins, 2016). A general review of potential roosting resource was also carried out within the Study Area.

¹ <https://sitelink.nature.scot/home>

Table 2.1 Criteria for assessing the potential suitability of a proposed development site for bats

Suitability	Description of roosting habitat	Commuting and foraging habitat
Negligible	Negligible habitat features on site likely to be used by roosting bats.	Negligible habitat features likely to be used by commuting or foraging bats.
Low	<p>A structure with one or more potential roost sites that could be used by individual bats opportunistically. However, these potential roost sites do not provide enough space, shelter, protection, appropriate conditions and/or suitable surrounding habitat to be used on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation).</p> <p>A tree of sufficient size and age to contain Potential roost features (PRFs) but with none seen from the ground or features seen with only very limited roost potential.</p>	<p>Habitat that could be used by small numbers of commuting bats such as a gappy hedgerow or unvegetated stream, but isolated, i.e. not very well connected to the surrounding landscape by other habitat.</p> <p>Suitable but isolated habitat that could be used by small numbers of foraging bats such as a lone tree (not in a parkland situation) or a patch of scrub.</p>
Moderate	A structure or tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status (with respect to roost type only – the assessments in this table are made irrespective of species conservation status, which is established after presence is confirmed).	<p>Continuous habitat connected to the wider landscape that could be used by bats for commuting such as lines of trees and scrub or linked back gardens.</p> <p>Habitat that is connected by the wider landscape that could be used by bats for foraging such as trees, scrub, grassland or water.</p>
High	A structure or tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.	<p>Continuous high-quality habitat that is well connected to the wider landscape that is likely to be used regularly by commuting bats such as river valleys, streams, hedgerows, lines of trees and woodland edge.</p> <p>High quality habitat that is well connected to the wider landscape that is likely to be used regularly by foraging bats such as broadleaved woodland, tree lined watercourses and grazed parkland.</p> <p>Site is close to and connected to known roosts.</p>

Note: Information within the table has been extracted from Collins (2016).

Presence/ absence survey

- 2.3.2 Dusk emergence and dawn re-entry surveys were conducted at Lorg Farmhouse between July and September 2020. Survey dates, times, and weather conditions are detailed in **Table 2.2**. Bat calls were recorded using Batlogger M bat detectors. Recordings were then analysed by an experienced ecologist using specialist BatExplorer Software to confirm bat species present.
- 2.3.3 In accordance with good practice guidelines, dusk emergence surveys commenced approximately 30 minutes before sunset and continued until at least 90 minutes after sunset. Dawn re-entry surveys began at least 90 minutes before sunrise and continued until 15 minutes after sunrise.

Table 2.2 Presence/ absence survey dates, timing, and weather conditions

Date	Survey type	Sunrise/ sunset	Survey start	Survey end	Weather conditions
13.07.20	Dusk emergence	21:50	21:20	23:33	13 -11°C, dry and overcast with moderate breeze.
19.08.20	Dawn re-entry	06:00	04:15	06:15	17 - 15 °C, dry and overcast with low cloud and light breeze.
23.09.20	Dawn re-entry	07:06	05:20	07:20	8 - 5 °C, dry and overcast with gentle breeze.

Bat activity survey

Automated detector survey

- 2.3.4 Automated bat detector units (Wildlife Acoustics SM4BATFS) were deployed within the Study Area to record bat echolocation calls throughout the entire night, for a minimum of ten consecutive nights over three monitoring periods during the active bat season (April to October). The detectors were set up to record bat echolocation calls continuously from 30 minutes before sunset to 30 minutes after sunrise. **Table 2.3** presents the dates of monitoring.
- 2.3.5 The automated detectors were placed at 11 proposed turbine locations in order to provide a representative sample of bat activity at or close to these points. An additional detector was deployed in June 2020 at the base of the valley near the Water of Ken so as to provide a reference monitoring location and to align with the distribution of automated detectors during surveys carried out in 2012². The location of each automated detector is displayed in **Figure 1.1** and detailed in **Appendix B**.

Table 2.3 Summary of automated detector monitoring periods

Month	Monitoring dates	No. of monitoring nights
May (Spring)	06.05.20 – 19.05.20	13
June – July (Summer)	26.06.20 – 09.07.20	13
August (Autumn*)	13.08.20 – 26.08.20	13

* SNH et al (2021) suggests that the Autumn season corresponds to mid-August – October, ideally spanning from mid-August - mid-September based on a review of bat activity data from southern Scotland.

2.4 Data analysis

Species identification

- 2.4.1 Analysis of bat recordings was carried out with reference to Russ (2012). Where records were not identified to species level during the sound analysis process, for example due to the overlapping call parameters of some species; records were identified to genus or species group. The following groups were used:

² Natural Power (2012). Afton 2 Baseline Ecology Report.

- Myotis sp. (bat species in the genus Myotis);
 - Nyctalus sp. (noctule or Leisler's bat);
 - Pipistrellus sp. (common pipistrelle or soprano pipistrelle); and
 - Bat sp. (calls that could not be ascribed to a species group).
- 2.4.2 Recordings of bats in the genus Myotis were usually grouped together, as these species in particular, have widely overlapping call parameters.
- 2.4.3 The scientific names of bat species/ species groups presented in this report are provided in **Appendix C**.

Ecobat

- 2.4.4 Following analysis of bat records, the data were then processed using Ecobat software³ to gain a measure of relative bat activity across the Study Area. Ecobat is an online tool that compares data collected by automated bat detectors within the Study Area with data collected by the same means at the same time of year within a defined search area. The reference range data set were stratified to include:
- Only records from within 30 days of the survey dates; and
 - Records within a 100km radius of the Site.
- 2.4.5 Through generating a percentile rank for each night of bat activity, the Ecobat tool can identify the number of nights in which the recorded level of bat species activity, as collected by an automated bat detector, could be considered to represent 'high', 'moderate/ high', 'low/moderate', or 'low' in the context of the geographical region, as shown in **Table 2.4**.

Table 2.4 Percentile score and categorised level of bat activity

Percentile score	Bat activity level
81 - 100	High
61 - 80	Moderate - High
41 - 60	Moderate
21 - 40	Low - Moderate
0 - 20	Low

Extracted from SNH *et al* (2021).

Potential Collision Risk Assessment

- 2.4.6 Estimating the vulnerability of bat populations to windfarms is based on the following three key factors:
- Relative abundance;
 - Collision risk; and
 - Bat activity recorded at the Site.

³ <http://www.ecobat.org.uk/>

2.4.7 The first two of these factors is pre-defined in guidance (SNH *et al*, 2021), with species categorised as set out in **Table 2.5**.

Table 2.5 Level of potential vulnerability of populations of bat species in Scotland

Relative abundance		Collision risk		
		Low	Medium	High
	Common species			Common pipistrelle Soprano pipistrelle
	Rarer species	Brown long-eared bat Daubenton's bat Natterer's bat		
	Rarest species	Whiskered bat Brandt's bat		Nathusius' pipistrelle Noctule Leisler's bat

Table extracted from SNH *et al* (2021). Yellow – low population vulnerability; Amber – medium population vulnerability; Red – high population vulnerability.

2.4.8 Using the outputs from the Ecobat analysis, the assessment of potential collision risk for bats has been carried out following the two-stage process outlined in current guidance (SNH *et al*. 2021) for all those species identified within the Study Area that are listed as 'High Collision Risk' in **Table 2.5**. Stage 1 provides an indication of the potential Site risk based on evaluation of habitat and the size of the development (see **Table 2.6**). For full details on how habitat risk and project size is determined, please refer to **Annex D**.

Table 2.6 Initial site risk assessment

Habitat risk		Project size		
		Low	Medium	High
	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5

Table extracted from SNH *et al* (2021). Green (1 – 2) – lowest/ low site risk; Amber (3) – medium site risk; Red (4 – 5) – highest/ high site risk

2.4.9 Stage 2 requires an overall assessment of risk, which can be made by considering the results of the initial Site risk assessment in relation to bat activity output from Ecobat. This then considers the relative vulnerability, at population level, of each species of bat present (see **Table 2.7**).

Table 2.7 Stage 2 – Overall risk assessment

Site risk level (from Table 2.6)	Ecobat activity category (or equivalent justified categorisation)					
	Nil (0)	Low (1)	Low – moderate (2)	Moderate (3)	Moderate – high (4)	High (5)
Lowest (1)						
Low (2)		1	2	3		
Medium (3)		2	3	4		
High (4)		3	4	5		
Highest (5)						

Overall assessment: Low (green) – 0-4; Medium (amber) 5 -12; High (red) – 15 - 25

2.5 Limitations

Bat activity survey

- 2.5.1 Due to issues associated with automated detector microphone damage, it was not possible to obtain data for the following monitoring locations and time periods:
- Location A – between 8 and 9 July 2020;
 - Location D – between 3 July and 9 July 2020;
 - Location H - between 27 June and 9 July 2020; and
 - Location K – between 20 and 26 August 2020.
- 2.5.2 In addition, the automated detector at location L was not deployed until the summer 2020, hence there is no data available for the spring monitoring period at this location.
- 2.5.3 Despite these limitations, it is considered that data collected from surrounding monitoring locations during these time periods provides sufficient coverage and a suitable representation of bat activity within the Study Area.

Ecobat

- 2.5.4 The Ecobat analysis tool provides a variety of outputs that are useful for interpreting the importance of a site with respect to bat activity and distribution. However, it is important to note that these outputs are considered in the context of the wider data collection from third parties, and the accuracy of results requires a considerable number of records to be present. For example, a reference range (i.e. the number of nights for each species that the data is compared to) of at least 200 is recommended to be confident in the relative activity level.
- 2.5.5 Due to an ongoing technical issue relating to the summing of genus level species in Ecobat application, there is potential for the sum of *Pipistrellus* and *Nyctalus* species calls, and thus the relative activity level of each genus, to be underestimated. For example, during nights in which both common pipistrelle and *Pipistrellus* species were recorded, the number of contacts for both will be added to the total sum for *Pipistrellus*. However, on nights where common pipistrelle was recorded but *Pipistrellus* was not, the sum of common pipistrelle

- contacts will not be added to the overall *Pipistrellus* count, thus leading to an underestimation of total *Pipistrellus* contacts.
- 2.5.6 Due to the overlapping call parameters of each *Myotis* species, all contacts relating to this species group have been assigned to genus level only and assessed in Ecobat as such. Contacts assigned as *Myotis* species, and associated relative activity levels, are therefore less likely to be underestimated in the Ecobat application.
- 2.5.7 This technical issue is currently being addressed by the Mammal Society, who are in the process of constructing an updated version of Ecobat.

3. Results

3.1 Desk study

Statutory and non-statutory designated sites

- 3.1.1 There are no statutory or non-statutory biodiversity sites designated for bat conservation within 10 km of the Site boundary.

Bat records

- 3.1.2 Results returned from SWSEIC relating to bat species in flight within 15 km of the Site boundary are presented in **Table 3.1**. Only records between years 2010 and 2020 were included in the search. Records of at least eight species were returned.

Table 3.1 Bat species records obtained from SWSEIC (2010-2020)

Species	Number of records	Year of most recent record	Conservation designation
<i>Myotis</i> bat species	3	2016	HabRegs2, WCA5, DG-LBAP, SBL
Whiskered/ Brandts bat	4	2016	HabRegs2, WCA5
Daubentons bat	2	2016	HabRegs2, WCA5, DG-LBAP, SBL
Natterers bat	7	2016	HabRegs2, WCA5, DG-LBAP, SBL
<i>Nyctalus</i> bat species	1	2016	HabRegs2, WCA5, SBL, DG-LBAP
Noctule bat	2	2016	HabRegs2, WCA5, SBL, DG-LBAP
Leislars bat	11	2016	HabRegs2, WCA5, DG-LBAP
Pipistrelle bat	12	2016	HabRegs2, WCA5, DG-LBAP
Common pipistrelle bat	13	2016	HabRegs2, WCA5, DG-LBAP
Soprano pipistrelle bat	12	2016	HabRegs2, WCA5, DG-LBAP, SBL
Brown long-eared bat	1	2016	HabRegs2, WCA5, DG-LBAP, SBL

HabRegs2 – The Conservation (Natural Habitats & c) Regulations 1994 (Schedule 2); WCA 5 – Wildlife and Countryside Act (Schedule 5); DG-LBAP – Dumfries and Galloway Local Biodiversity Action Plan; SBL – Scottish Biodiversity List

- 3.1.3 No data relating to bat roost records were obtained from SWSEIC.

Previous survey work

Presence/ absence survey

- 3.1.4 As detailed in the 2015 ES (Amec Foster Wheeler, 2015), roosting bats were identified at Lorg Farmhouse in 2012 by FDM Ecology, with additional survey work carried out in 2013

by Amec Foster Wheeler. The emergence surveys confirmed the presence of a small, non-maternity summer soprano pipistrelle roost (Amec Foster Wheeler, 2015).

- 3.1.5 It was concluded that due to the isolation of the Lorg Farmhouse from suitable foraging habitat, the structure was unlikely to offer any greater opportunities as a resource for roosting bats than a small, non-maternity summer roost.

Bat activity survey

- 3.1.6 Automated detector monitoring carried out during 2012 to inform the 2015 ES confirmed that four bat species/ species groups utilise the Site⁴. These included common pipistrelle, soprano pipistrelle, Daubenton's bat, and brown long-eared bat. Low levels of activity⁵ were recorded on open hill tops within the Site, while significantly higher levels of activity⁶ were recorded at reference locations positioned within areas of suitable bat habitat (located within the centre and along the periphery of the Site). The majority of activity recorded at sample locations positioned within open upland habitat was considered to represent commuting bats that may occasionally forage across open land as they pass between areas of more suitable habitat. In contrast, reference locations within the centre of the Site appeared to serve as foraging hotspots, some of which were located within close proximity to the bat roost at Lorg Farmhouse.
- 3.1.7 In addition to those surveys carried out in 2012, automated detectors were deployed at two meteorological (met) mast locations in 2013, known as 'Lorg East' and 'Lorg West'. A total of 303 bat contacts⁷ were recorded between April and October 2013 which is considered to represent very low levels of bat activity. Almost all bat contacts recorded were related to activity at ground level as opposed to at activity at height⁸. Bat species/ species groups identified during the monitoring period included *Nyctalus* bat species, common pipistrelle, soprano pipistrelle, and *Myotis* bat species. As with the 2012 results, the data obtained in 2013 suggested that small numbers of bats utilise the Site for commuting and opportunistic foraging opportunities between roosts and areas of higher foraging value, which are assumed to be elsewhere in the Water of Ken catchment.

Field survey

Habitat assessment

- 3.1.8 The landscape within the Study Area is dominated by open moorland composed primarily of rush pasture, purple moor grass mire, blanket bog, acid grassland, and flush habitat. It is managed for livestock grazing, while commercial forestry plantation surrounds much of the periphery of the Study Area (**Figure 1.1**). While open moorland is generally considered to support low suitability for foraging bats, it may serve as a commuting pathway between areas of more suitable foraging and roosting habitat. In addition, while coniferous plantation generally provides low suitability for roosting bats, tree lines may serve as edge habitat and

⁴ Note that the red-line boundary to the northwest of the 'Site' has been amended following survey work conducted in 2012.

⁵ Range of average nightly contacts per species recorded on open hilltops (extracted from FDM Ecology 2012, Appendix I – Table 8): common pipistrelle - 0 to 3.79; soprano pipistrelle – 0 to 0.72; Pipistrellus species – 0; Daubenton's bat – 0 to 1.73; Myotis species - 0 to 0.26; and brown long-eared bat – 0.

⁶ Range of average nightly contacts per species recorded in reference locations: common pipistrelle – 2.45 to 264.53; soprano pipistrelle: 2.65 to 120.14; Pipistrellus species – 0 to 7.18; Daubenton's bat – 0 to 23.99; Myotis species – 0.143 – 2.18; brown long-eared bat – 0.

⁷ A total of 303 bat contacts were recorded, of which 283 of which were attributed to Lorg East met mast with the remaining 20 contacts attributed to Lorg West met mast.

⁸ Due to issues associated with electrical interference, it was not possible to obtain data relating to bat activity at height for Lorg West met mast. At Lorg East met mast only one bat contact (a soprano pipistrelle) was recorded at height in August 2013.

provide a means of navigation for commuting and foraging purposes. Based on habitat features present, the Study Area was assessed as having Moderate suitability for commuting and foraging bats.

- 3.1.9 Lorg Farmhouse is located at the base of a valley close to the centre of the Study Area. The Water of Ken is situated approximately 220 m south of the farmhouse, while Lorg Burn and its tributaries are located approximately 200 m south-west. Two small stands of broadleaved woodland are positioned immediately adjacent to the farmhouse building. Of the habitats within the Survey Area, these habitats which surrounds Lorg Farmhouse are considered to be most suitable for commuting and foraging bats.
- 3.1.10 Lorg Farmhouse was considered to offer the only potential roosting features within the Study Area, being confirmed as a roost site during 2012 and 2013 surveys.

Presence/ absence survey

- 3.1.11 The results of the presence/ absence surveys carried out at Lorg Farmhouse in 2020 are summarised in **Table 3.2**.

Table 3.2 Summary of Lorg Farmhouse emergence/ re-entry survey results

Date	Survey type	Species recorded	Details
13-07-2020	Dusk emergence	Common pipistrelle Soprano pipistrelle <i>Myotis</i> species	Commuting and foraging common and soprano pipistrelle activity recorded around the building and in surrounding broadleaved trees throughout the survey. Occasional <i>Myotis</i> pass between 22:46hrs and 23:31hrs. Single unknown bat species emergence under ridge tile on northwest aspect of porch (recorded on infrared camera).
19-08-2020	Dawn re-entry	Common pipistrelle Soprano pipistrelle <i>Myotis</i> species	Common and soprano pipistrelle foraging activity recorded around the building between 04:15 and 05:40hrs. <i>Myotis</i> activity recorded between 05:15 and 05:19hrs. Re-entry recorded by single common pipistrelle under a roof tile on porch at 05:40am and in cavity below chimney on southwest aspect at 05:38am.
23-09-2020	Dawn re-entry	Common pipistrelle Soprano pipistrelle	Common and soprano pipistrelle commuting and foraging activity recorded throughout the survey. A common pipistrelle was observed entering the open window on the southeast facing gable end at 06:15am, before emerging again (as indicated by arrow in Photo 3). Soprano pipistrelle re-entry recorded under slates at southeast facing gable end of building at 06:26am.

- 3.1.12 Individual bats of the genera *Pipistrellus* were recorded emerging from or re-entering the farmhouse during all three surveys, with common and soprano pipistrelle confirmed to utilise the building for roosting. The location of emergence/ re-entry points are illustrated in Photographs 1, 2 and 3 below.
- 3.1.13 The surrounding habitat, comprising broadleaved trees, marshy grassland, grazing pasture, and watercourses; also serves as commuting and foraging habitat, with several bats heard foraging and commuting in the local area.
- 3.1.14 It is considered that sufficient survey effort has been employed to demonstrate that the farmhouse is used regularly as a small, non-maternity summer roost for *Pipistrellus* species.



Photo 1: Emergence and re-entry point under ridge tile and slate on northwest aspect of porch. CP – common pipistrelle.



Photo 2: Re-entry point in crevice between slates and stonework at the front of the house.



Photo 3: Re-entry point under slates at gable end of building facing southeast.

Hibernation suitability

- 3.1.15 The hibernation period for bats typically spans November to March inclusive, though this is dependent on temperature conditions. During this time, bats enter extended periods of torpor where their metabolic rates, body temperature and breathing rate are reduced to coincide with colder temperature and subsequent lack of insect feeding resources. Bats may hibernate as individuals or in small groups within roosts that offer appropriate climatic conditions, i.e. stable low temperatures above freezing and high relative humidity and a low level of disturbance.
- 3.1.16 *Pipistrellus* bats are often encountered hibernating in cracks and crevices within built structures during winter and have also been known to hibernate in the same roosts they utilise during summer. Lorg farmhouse is formed of thick stone and therefore likely to provide suitable conditions for hibernating bats. Given that the farmhouse building is a confirmed summer roost site for *Pipistrellus* bats, the potential exists for small numbers of bats to utilise the building for hibernation purposes during winter months.

Bat activity survey

Automated detector survey

- 3.1.17 The environmental conditions for each night of recording are displayed in **Appendix E**. Full details of the automated monitoring results are provided in **Appendix F**.
- 3.1.18 The term 'contact' has been used to describe a unit of bat activity. One contact equates to a single file recorded on the bat detector containing a sequence of bat calls made by a single bat. Where a file clearly contains two bats recorded at the same time, that has been counted as two contacts.
- 3.1.19 The number of contacts and average contacts per night recorded at each location is summarised in **Table 3.3**. Average contacts per night are calculated based on the number of nights of data being analysed for each location, to provide an index of bat activity. These data are intended to give an indication of relative levels of bat activity at each location and do not represent actual numbers of bats. A single bat may pass the same location repeatedly during the same evening, thus increasing the number of contacts recorded at that location. Equally, the same bat may pass more than one monitoring location, therefore being recorded by more than one detector during the same monitoring period.

Table 3.3 Summary of automated detector monitoring results 2020

Location	Number of nights analysed	Total number of contacts (average per night)								
		CP	SP	CP/SP	CP/NP	N	<i>Nyctalus</i>	<i>Myotis</i>	BLE	Total
A	37	5 (0.14)	36 (0.97)	17 (0.46)	0 (0.00)	65 (1.76)	58 (1.57)	0 (0.00)	1 (0.03)	182 (4.91)
B	39	3 (0.08)	20 (0.51)	14 (0.36)	0 (0.00)	81 (2.08)	886 (2.21)	3 (0.08)	0 (0.00)	207 (5.31)
C	39	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
D	32	7 (0.22)	24 (0.75)	6 (0.19)	1 (0.03)	68 (2.13)	44 (1.38)	18 (0.56)	1 (0.03)	169 (5.28)
E	39	13 (0.33)	28 (0.72)	22 (0.56)	0 (0.00)	66 (1.69)	79 (2.03)	10 (0.26)	3 (0.08)	221 (5.67)
F	39	12 (0.31)	26 (0.67)	18 (0.46)	0 (0.00)	44 (1.13)	68 (1.74)	7 (0.18)	3 (0.08)	178 (4.56)
G	39	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2 (0.05)	0 (0.00)	2 (0.05)
H	27	8 (0.30)	8 (0.30)	4 (0.15)	0 (0.00)	21 (0.78)	18 (0.67)	0 (0.00)	0 (0.00)	59 (2.19)
I	39	4 (0.10)	7 (0.18)	8 (0.21)	0 (0.00)	47 (1.21)	22 (0.56)	1 (0.03)	2 (0.05)	91 (2.33)
J	39	2 (0.05)	1 (0.03)	0 (0.00)	0 (0.00)	8 (0.21)	12 (0.31)	3 (0.08)	0 (0.00)	26 (0.67)
K	32	6 (0.19)	13 (0.41)	10 (0.31)	0 (0.00)	25 (0.78)	11 (0.34)	2 (0.06)	0 (0.00)	67 (2.09)

Location	Number of nights analysed	Total number of contacts (average per night)								
		CP	SP	CP/SP	CP/NP	N	<i>Nyctalus</i>	<i>Myotis</i>	BLE	Total
L	26	641 (24.65)	199 (7.65)	797 (30.65)	6 (0.23)	4 (0.15)	46 (1.77)	8 (0.31)	3 (0.08)	1704 (65.5)
Total	427	701	362	896	7	429	444	54	13	2906 (6.81)
Proportion		24.12%	12.46%	30.83%	0.24%	14.76%	15.28%	1.86%	0.45%	

Species codes: CP = common pipistrelle; SP = soprano pipistrelle; CP/SP = common/soprano pipistrelle (*Pipistrellus* species); CP/NP = common/ *Nathusius*' pipistrelle (*Pipistrellus* species); N = Noctule; *Nyctalus* = *Nyctalus* bat species; M = *Myotis* bat species; and BLE = brown long-eared bat.

3.1.20 **Table 3.3** and the data presented in **Appendix F** shows that:

- The automated detectors recorded a total of 2,907 contacts from at least five species over 427 monitoring nights (averaging 6.81 contacts per night).
- The most frequently encountered species group was *Pipistrellus sp.* accounting for 31.07%⁹ of contacts, with activity recorded across nine monitoring locations. By far the greatest level of *Pipistrellus* (CP/SP) activity was recorded during Autumn at reference location L (averaging 59.31 contacts per night) (**Table F.3 Appendix F**). This reference location was situated close to the Water of Ken, within the valley in the centre of the Study Area.
- The most recorded species was common pipistrelle, accounting for 24.12% of contacts. The greatest level of common pipistrelle activity was also recorded at reference location L, during the summer survey period (averaging 30.15 contacts per night) (**Table F.2 Appendix F**).
- Soprano pipistrelle accounts for 12.46% of total contacts. The greatest level of soprano pipistrelle activity was recorded at reference location L in Autumn (averaging 1.83 contacts per night).
- There were no confirmed recordings of *Nathusius*' pipistrelle made within the Study Area, however several contacts were categorised as potentially *Nathusius*' pipistrelle due to the overlapping parameters between the calls of these two species (characterised by echolocation call frequencies between 40 and 42 kHz). These contacts were recorded at reference location L during Summer and Autumn and at monitoring location D during Autumn 2020. However, as the Study Area is positioned outside the known range for *Nathusius*' pipistrelle¹⁰, these contacts more likely relate to common pipistrelle flying across open habitat.
- Records of *Nyctalus* species (noctule and Leisler's) total 30.04% of contacts. The greatest level of *Nyctalus* activity was recorded during Autumn, with contacts recorded at 10 monitoring locations across the Study Area. The highest level of *Nyctalus* activity was recorded at monitoring location B (averaging 6.62 12.85 contacts per night).
- The remaining limited number of contacts were attributed to *Myotis* species (1.86%) and brown long-eared bat (0.45%).

⁹ This number relates to the proportion of CP/SP (30.83%) and NP/CP (0.24%) combined.

¹⁰ Information relating to the distribution and range of *Nathusius*' pipistrelle in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1317-SC-Habitats-Directive-Art17-2019.pdf>

- In terms of activity between seasons, the lowest levels of bat activity were recorded during the Spring monitoring period, with a total of 16 contacts recorded across 11 automated detectors (averaging 0.11 contacts per night) (**Appendix F**). However, as reference location L was not deployed during the Spring monitoring period, it is considered likely that overall activity levels would have been accordingly higher if activity data had been captured during this period. Bat activity increased during the summer monitoring period, with a total count of 540 contacts recorded across 11 automated detectors (4.00 contacts per night). The level of activity was then found to peak in Autumn, with 2,350 contacts recorded across 12 automated detectors (15.77 contacts per night).
- In terms of activity between monitoring locations, the highest level of bat activity was recorded at reference Location L, with a total of 1,704 contacts over 26 monitoring nights (averaging 65.54 contacts per night).
- In contrast, the lowest overall level of bat activity was recorded at monitoring Locations C (no contacts recorded over 39 monitoring nights) and G (a total of 2 contacts recorded over 39 monitoring nights), averaging 0.00 and 0.05 contacts per night respectively. Both Location C and G were located within the south-east of the Study Area. Location C was positioned approximately 420m AOD within open habitat between the Pulmulloch Burn and Altry hill, while Location G was positioned on the northern slope of Black Hill, at approximately 530m AOD.

3.1.21 A diagram illustrating the percentage of bat species contacts recorded at each monitoring location is displayed in **Chart 3.1** below.

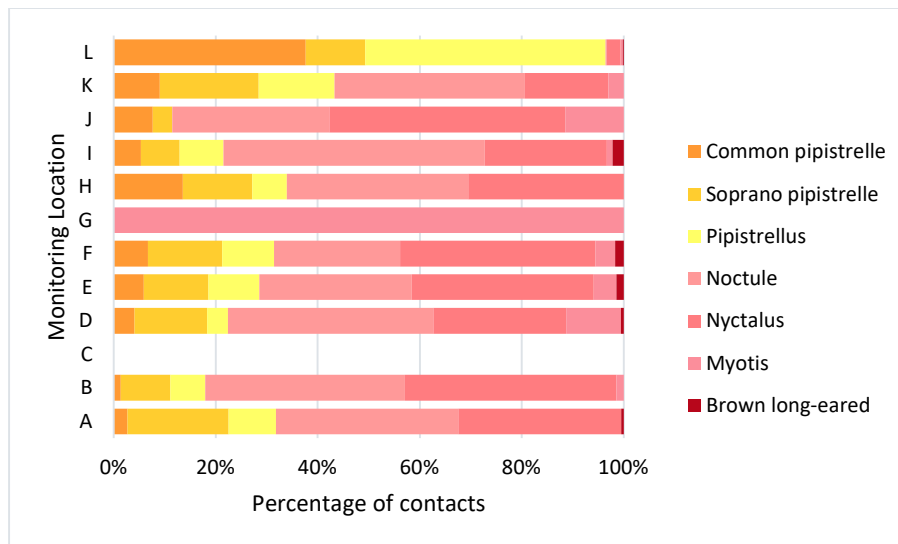


Chart 3.1 Percentage species/ species group composition of contacts at each monitoring location

First contact times

3.1.22 A summary of the earliest or latest contact time for each species and species group is provided in **Table 3.4** along with the species-specific emergence time ranges. Contacts that occur within these times ranges may potentially indicate the presence of a nearby roost. A summary of the earliest contact times for each species and species group is provided below:

- No early contacts relating to common pipistrelle bats were recorded during the survey period.

- Several early soprano pipistrelle contacts were recorded at reference location L during the Summer survey period, with the earliest contact recorded 13 minutes after sunset on 08 July 2020.
- No early contacts relating to the genus *Nyctalus* were recorded during the survey period. The earliest contact was made at location L in Autumn, 17 minutes after sunset on 19 August 2020.
- No early contacts relating to *Myotis* or brown-long eared bats were recorded during the survey period.

Table 3.4 Earliest/ latest contact times (in hours and minutes, hh:mm) after sunset/ before sunrise per species/ species group for each monitoring location.

Location	Species/ species group						
	CP	SP	CP/SP	CP/NP	<i>Nyctalus</i>	M	BLE
A	01:07	00:40	00:54	-	00:31	-	01:59
B	01:07	00:37	00:39	-	00:24	01:54*	-
C	-	-	-	-	-	-	-
D	01:25	00:54	01:27	01:33*	00:33	01:42	02:41
E	01:16	00:46	00:35	-	00:26	01:50*	02:22
F	00:48	00:41	00:39	-	-	-	02:03*
G	-	-	-	-	-	05:06*	-
H	01:12	01:02	01:36	-	00:24	-	-
I	02:00	01:16	01:18	-	00:36	02:18*	01:54*
J	00:43	00:39	-	-	00:36	-	-
K	00:55	00:47	00:50	-	00:29	01:55*	-
L	00:34	00:13	00:33	00:46	00:17	01:02	02:08*

* Denotes latest contact time before sunrise (i.e. 04:13* equates to 4 hours and 13 minutes before sunrise). Approximate emergence times of bat species (University of Bristol, 2005): CP - 20-30 minutes; SP - 20-30 minutes; CP/SP - 20 – 30 minutes; CP/NP - 20 – 30minutes; Nyc – 0-20 minutes, *Myotis* species - variable; and BLE - 60 minutes.

Ecobat

3.1.23 Summary data relating to bat activity levels recorded within the Study Area is provided in **Table 3.5**. Note that Ecobat results for reference monitoring location L have been provided

separately in **Table 3.6**. This is because while reference location L is positioned within the Study Area, it is a reference location only and the closest proposed turbine infrastructure is positioned >1km from this location. Bat activity levels for reference location L have been assessed individually to ensure that the results for this location do not skew data relating to bat activity within the proposed turbine envelope. For further results relating to site-wide activity levels and activity levels at each monitoring location, please refer to **Appendix G**.

Table 3.5 Summary table indicating the activity level (percentile) of bats recorded across the Study Area (excluding reference location L)

Species/species group	Median percentile	Median percentile activity category	95% CIs	Max percentile	Max percentile activity category	Nights Recorded
CP	1	Low	31 - 31	60	Moderate	38
SP	46	Moderate	30.5 - 60	81	High	49
<i>Pipistrellus</i> *	31	Low - moderate	16 - 57	68	Moderate - high	42
<i>Nyctalus</i> **	73	Moderate - High	65 – 89.5	93	High	73
<i>Myotis</i>	1	Low	46 - 46	77	Moderate - high	20
BLE	1	Low	16 - 16	31	Low - moderate	9

* *Pipistrellus species* accounts for contacts classified as common/ soprano pipistrelle (CP/SP) or Nathusius'/common pipistrelle (NP/CP) during sound analysis – it does not account for individual contacts classified as either common or soprano pipistrelle.

** Contacts relating to Noctule and *Nyctalus* species were combined for the purpose of Ecobat activity and site risk analysis.

3.1.24 From the data presented in **Table 3.5**, the following observations can be made:

- Common pipistrelle: Data suggests an overall 'Low' level of activity across the Study Area (median percentile of 1), with periods of 'Moderate' activity also recorded during the survey period (max percentile of 60)¹¹. The respective reference range was 2,933, thus indicating high confidence in the accuracy of the comparison (**Table G.2 in Appendix G**);
- Soprano pipistrelle: Data indicates an overall 'Moderate' level of activity across the Study Area (median percentile of 46), with occasional 'High' activity also recorded during the survey period (max percentile of 81)¹². The respective reference range was 3,170, indicating high confidence in the accuracy of the comparison;
- *Pipistrellus* species: Data indicates an overall 'Low to Moderate' level of activity across the Study Area, (maximum percentile 31) with periods of 'Moderate to High' levels of activity also recorded (maximum percentile 68)¹³. The respective reference range was 2976, thus allowing confidence in the level of comparison;
- *Nyctalus* species: Data indicates and overall 'Moderate to High' level of activity across the Study Area (median percentile 73), with occasions of 'High' activity also recorded during the survey period (maximum percentile of 93). The respective reference range was 1,921, allowing confidence in the accuracy of comparison;

¹¹ 'Moderate to high' common pipistrelle activity was recorded at location H in Autumn (**Table G.3 in Appendix G**).

¹² 'High' soprano pipistrelle activity was recorded at location A during Summer monitoring period (**Appendix G**).

¹³ 'Moderate to high' *Pipistrellus* species activity was recorded at locations A, B, E and F in Autumn (**Appendix G**).

- Myotis species: Data indicates an overall 'Low' level of activity across the Study Area (median percentile of 1), with occasions of 'Moderate to High' activity also recorded during the survey period (max percentile of 77)¹⁴. The respective reference range was 1,123, indicating high confidence in the accuracy of the comparison; and
- Brown long eared bat: Data indicates an overall 'Low' level of activity across the Study Area (median percentile of 1), with occasions of 'Low to Moderate' activity also recorded (max percentile of 31). Due to a lack of available records for this species within 100km of the Site for comparison (respective reference range of 117), there is a low degree of confidence in these results.

Table 3.6 Summary table indicating the activity level (percentile) of bats recorded at reference location L

Species/species group	Median percentile	Median percentile activity category	95% CIs	Max percentile	Max percentile activity category	Nights Recorded
CP	83	High	74.5 – 89.5	97	High	23
SP	67	Moderate - High	56 - 80	91	High	21
<i>Pipistrellus</i> *	59	Moderate - High	53 - 85	98	High	19
<i>Nyctalus</i> **	45	Moderate	44.5 - 62	79	Moderate - High	14
<i>Myotis</i>	30	Low- moderate	30 - 30	30	Low- Moderate	5
BLE	0	Low	0 - 0	0	Low	3

**Pipistrellus species* accounts for contacts classified as common/ soprano pipistrelle (CP/SP) or Nathusius'/common pipistrelle (NP/CP) during sound analysis – it does not account for individual contacts classified as either common or soprano pipistrelle.

** Contacts relating to Noctule and *Nyctalus* species were combined for the purpose of Ecobat activity and site risk analysis.

3.1.25 From the data presented in **Table 3.6**, the following observations can be made:

- Common pipistrelle: Data suggests an overall 'High' level of activity at reference location L (median percentile of 83)¹⁵;
- Soprano pipistrelle: Data indicates an overall 'Moderate to High' level of activity at reference location L (median percentile of 67, with occasions of 'high' activity also recorded during the survey period (max percentile of 91)¹⁶;
- *Pipistrellus* species - data indicates an overall 'Moderate to High' level of activity at reference location L (maximum percentile 59) with periods of high levels of activity also recorded (maximum percentile 98);
- *Nyctalus* species: Data indicates and overall 'Moderate' level of activity at reference Location L (median percentile 45), with occasions of 'Moderate to High' activity also recorded during the survey period (maximum percentile of 79);

¹⁴ 'Moderate to high' levels of Myotis activity were recorded at location D in Autumn and location E in Spring (**Appendix G**).

¹⁵ 'High common pipistrelle activity was recorded at reference location L during both Summer and Autumn monitoring periods (**Table G.3 in Appendix G**).

¹⁶ 'High' soprano pipistrelle activity was recorded at reference location L during both Summer and Autumn monitoring periods (**Appendix G**).

- *Myotis* species: Data indicates an overall 'Low to Moderate' level at reference location L (median percentile of 30); and
- Brown long-eared bat: Data indicates an overall 'Low' level of activity at reference location L (median percentile of 0). Due to a lack of available records for this species within 100km of the Site for comparison, there is a low degree of confidence in this result.

Potential collision risk assessment

Initial site risk assessment

- 3.1.26 An assessment of risk from the development can be made using the parameters outlined in the most recent SNH guidance (SNH *et al.* 2021).
- 3.1.27 The Proposed Development consists of 15 turbines with a tip height of up to 200 m and therefore falls within the category of 'large' project size.
- 3.1.28 In terms of habitat risk, the open upland habitat that covers much of the Site is considered to support low suitability for roosting and foraging bats. However, the presence of watercourses and woodland edge habitat may offer commuting pathways and provide added foraging opportunities within the Site.
- 3.1.29 Evidence of roosting bats at Lorg Farmhouse, as obtained during previous surveys, suggests that the valley within the centre of the Study Area provides good habitat suitability for foraging, commuting and roosting bats, however this is considered to be localised in nature.
- 3.1.30 Based on these observations, the habitat risk has therefore been assessed as 'moderate'. According to the parameters presented in **Table 2.5**, the initial site risk assessment score for the Site is 'high' (i.e. a score of 4).

Risk assessment for 'high collision risk' species

- 3.1.31 The results of the bat activity survey indicate that least three bat species classified as 'high collision risk' utilise the Study Area. These are common pipistrelle, soprano pipistrelle, bats of the genera *Pipistrellus* (common or soprano pipistrelle) and *Nyctalus* (both noctule and leislers bat) (SNH *et al.* 2021).
- 3.1.32 **Table 3.7** summarises this data with an overall risk assessment score for the Study Area based on median and maximum percentiles. At the time of writing, no infrastructure was proposed within at least 1 km of reference location L – this monitoring location has therefore been excluded from the collision risk assessment.

Table 3.7 Risk assessment scores for 'high collision risk' bat species

Species	Median percentile	Median risk category	Maximum percentile	Maximum risk category	Initial site risk score	Median risk category	Maximum risk category
CP	1	Low	60	Moderate	4	4	12
SP	46	Moderate	81	High	4	12	18
<i>Pipistrellus</i> *	31	Low - moderate	68	Moderate - high	4	8	15
<i>Nyctalus</i> **	73	Moderate - high	93	High	4	15	18

* *Pipistrellus species* accounts for contacts classified as common/ soprano pipistrelle (CP/SP) or Nathusius'/common pipistrelle (NP/CP) during sound analysis – it does not account for individual contacts classified as either common or soprano pipistrelle.

** Contacts relating to Noctule and *Nyctalus* species were combined for the purpose of Ecobat activity and site risk analysis.

3.1.33 Based on the data presented in **Table 3.7**, the overall risk assessment score for common pipistrelle has been classified as 'low' (score of 4). The results for soprano pipistrelle demonstrate an overall 'medium' collision risk (score of 12), while *Nyctalus* species results indicate an overall 'high' collision risk across the Study Area (score of 15). Both the median (i.e. the most frequent) activity percentile and the maximum (i.e. the highest) activity percentile have been displayed in the overall risk assessment in order to show both typical and unusually high levels of bat activity within the Study Area, so that potentially important peaks in activity are not overlooked.

4. Summary

4.1 Habitats

Commuting and foraging habitat

- 4.1.1 The Study Area is formed primarily by open upland habitat with commercial forestry lining the east and south-eastern boundary of the Site. Although the open upland landscape provides limited suitability for foraging bats, it may act as a commuting pathway to and from areas of more suitable foraging and roosting habitat (as indicated by high levels of *Nyctalus* activity across open habitat associated with monitoring locations A, B, D, E, and F in Autumn). Coniferous woodland edge habitat may also serve as a linear commuting and navigation pathway between areas of more suitable foraging habitat.
- 4.1.2 Watercourses and stands of broadleaved woodland within the valley at the centre of the Study Area offer the greatest opportunities for foraging bats, as demonstrated by the high number of *Pipistrellus* contacts recorded at reference location L in Summer and Autumn 2020.

Roosting habitat

- 4.1.3 Roosting *Pipistrellus* bats were confirmed at Lorg Farmhouse during presence/absence surveys. Based on activity levels recorded at reference location L, these roosting bats utilise the stands of broadleaved woodland and watercourses within the centre of the Study Area for commuting and foraging purposes on a regular basis.

Baseline Summary by Species

- 4.1.4 The survey results indicate that at least five bat species/species groups utilise the Study Area: common pipistrelle, soprano pipistrelle, brown long-eared bats, and bats of the genera *Nyctalus* and *Myotis*. The activity levels and distribution recorded suggest that bats utilise the Study Area primarily for commuting, with foraging and roosting activity limited to habitats and buildings within the valley in the centre of the Study Area.
- 4.1.5 **Table 4.1** presents a summary of bat species recorded within, or potentially occurring within the Study Area; along with a summary of data relating to each species.

Table 4.1 Summary of Survey Results

Species	Contextual and Desk Study Information	Activity Summary	Roosting Status
Common pipistrelle	<p>Common and widespread nationally and throughout south-west Scotland^{17,18}.</p> <p>The desk study and previous survey work show records of common pipistrelle bats in flight, with a roost present at Lorg Farmhouse.</p>	<p>Activity surveys and corresponding data output from the Ecobat tools shows an overall low level of common pipistrelle activity recorded across the monitoring locations A to K, with occasions of moderate activity also recorded (Table 3.4a). A total of one night of moderate to high activity, five nights of moderate activity, nine nights of low to moderate activity, and 23 nights of low activity were recorded (Table G.1 Appendix G).</p> <p>High levels of common pipistrelle activity were however recorded within the valley in the centre of the Study Area at reference location L, during all three monitoring periods in 2020 (Table 3.4b). The higher levels of activity recorded at this location are likely to relate to the bat roost at Lorg Farmhouse and increased abundance of available foraging habitat within the valley (including watercourses and pockets of broadleaved woodland surrounding Lorg Farmhouse).</p>	Emergence/ re-entry surveys show the presence of small numbers of common pipistrelle bats roosting within Lorg Farmhouse.
Soprano pipistrelle	<p>Common throughout south-west Scotland. Study Area is within known range for soprano pipistrelle¹⁹.</p> <p>The desk study and previous survey work returned records of soprano pipistrelle in flight, with small numbers of bats utilising features within Lorg Farmhouse as a roost.</p>	<p>Soprano pipistrelle were recorded at 10 monitoring locations within the Study Area and account for 12.46% of total contacts.</p> <p>Activity surveys and corresponding data output from the Ecobat tools shows an overall moderate level of soprano pipistrelle activity recorded across monitoring locations A to K, with occasions of high activity also recorded (Table 3.5). A total of one night of high activity, 12 nights of moderate to high activity, 12 nights of moderate activity, seven nights of low to moderate activity, and 17 nights of low activity were recorded (Table G.1 Appendix G). The night of high activity was associated with monitoring location A in Summer (Table G.3 Appendix G).</p> <p>Ecobat results for reference location L show an overall moderate to high level of soprano pipistrelle activity (Table 3.6), with high levels of soprano</p>	Small numbers of soprano pipistrelle bats utilise Lorg Farmhouse for roosting purposes.

¹⁷ Mathews, F., Kubasiewicz, L.M., Gurnell, J., Harrower, C., McDonald, R.A., Shore, R.F (2018). A review of the population and conservation status of British Mammals. A report by the Mammal Society under contract to Natural England, Natural Resources Wales and Scottish Natural Heritage.

¹⁸ Information relating to the distribution and range of common pipistrelle in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1309-SC-Habitats-Directive-Art17-2019.pdf>

¹⁹ Information relating to the distribution and range of soprano pipistrelle in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S5009-SC-Habitats-Directive-Art17-2019.pdf>

Species	Contextual and Desk Study Information	Activity Summary	Roosting Status
		pipistrelle activity also recorded during Summer and Autumn (Table G.3, Appendix G).	
Pipistrellus species	<p>As noted above, common and soprano pipistrelle are widespread nationally.</p> <p><i>Pipistrellus</i> species contacts relating to either common or Nathusius' pipistrelle were recorded during the survey (characterised by echolocation call frequencies between 40 and 42 kHz). However, as the Study Area is positioned outside the known range for this Nathusius' pipistrelle²⁰, these contacts most likely relate to common pipistrelle in open habitat.</p>	<p>Species in the genus <i>Pipistrellus</i> were recorded at nine monitoring locations within the Study Area, accounting for 31.07% of total contacts²¹. The greatest level of <i>Pipistrellus</i> species activity was recorded at monitoring location L in August, which was positioned in the valley at the centre of the Study Area, close to the Water of Ken.</p> <p>Data output from the Ecobat tool shows an overall low to moderate level of activity, with periods of moderate to high activity also recorded within the Study Area (excluding reference location L) (Table 3.5). A total of five nights of moderate to high activity, seven nights of moderate activity, 15 nights of low to moderate activity, and 15 nights of low activity were recorded during the survey period (Table G.1 Appendix G).</p>	As noted above, small numbers of <i>Pipistrellus</i> species utilise Lorg Farmhouse for roosting purposes.
Nyctalus bat species	<p><i>Nyctalus</i> bat species occurring in Scotland include the noctule and Leisler's bat. Both species display patchy distribution and range within Scotland.</p> <p>The range for noctule spans across parts of south and southwest Scotland and the central belt²². The Study Area is positioned very close to the known range for this species.</p> <p>The range for Leisler's is limited to pockets within west and south-west Scotland. The Study Area is located within the known range for this species²³.</p>	<p>Species of the genus <i>Nyctalus</i> were recorded at 10 monitoring locations within the Study Area, accounting for 30.04% of total contacts. The highest level of <i>Nyctalus</i> activity was recorded at monitoring location B in Autumn (averaging 12.85 contacts per night^{Error! Bookmark not defined.}).</p> <p>Data output from the Ecobat tools shows a high level of <i>Nyctalus</i> activity recorded across monitoring locations A to K (Table 3.7). A total of 24 nights of high activity, 23 nights of moderate to high activity, nine nights of moderate activity, four nights of low to moderate activity, and 13 nights of low activity were recorded (Table G.1 Appendix G).</p> <p>Ecobat results for reference location L show an overall moderate level of <i>Nyctalus</i> activity, with occasions of moderate to high activity recorded in Autumn (Table G.2, Appendix G, and Table H.2b in Appendix H).</p>	Generally low potential for roosting <i>Nyctalus</i> species within the Study Area.
Myotis bat species	Three <i>Myotis</i> bat species typically occur in Scotland, namely Daubenton's, Natterer's and whiskered bats.	Contacts from the genus <i>Myotis</i> were recorded at nine monitoring locations within the Study Area. The greatest level of <i>Myotis</i> activity was recorded at	Previous survey work recorded potential for <i>Myotis</i> bats to be roosting in Lorg Farmhouse (Amec Foster Wheeler, 2015).

²⁰ Information relating to the distribution and range of Nathusius' pipistrelle in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1317-SC-Habitats-Directive-Art17-2019.pdf>

²¹ This figure relates to the percentage of contacts for CP/SP and CP/NP (as displayed in **Table 3.3**) combined.

²² Information relating to the distribution and range of noctule in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1312-SC-Habitats-Directive-Art17-2019.pdf>

²³ Information relating to the distribution and range of Leisler's in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1331-SC-Habitats-Directive-Art17-2019.pdf>

Species	Contextual and Desk Study Information	Activity Summary	Roosting Status
	<p>Daubenton's bat is common and relatively widespread throughout Scotland and the Study Area is positioned within the known range for this species²⁴.</p> <p>The range for Natterer's bat spans across the Scottish Central belt into parts of south-west Scotland, and as isolated pockets within Aberdeenshire and the Black Isle. The Study Area lies within/ is very close to the known range for this species¹⁷.</p> <p>The known range for Whiskered bat is limited to small pockets within west and south-west Scotland¹⁷. Therefore, this species is unlikely to occur within the Study Area.</p> <p>The desk study returned several records of <i>Myotis</i> bat species in flight (including whiskered, Natterer's and Daubenton's) within 15 km of the Site boundary.</p>	<p>monitoring location D in Autumn (Appendix F), of which was positioned approximately 120m east of the Pullmulloch Burn.</p> <p>Data output from the Ecobat tool shows an overall low to moderate level of activity across the Study Area, with occasions of moderate to high activity recorded during the survey period (Table 3.5 and Table 3.6).</p>	<p>However, whilst <i>Myotis</i> bats were recorded in flight during the 2020 emergence/ re-entry surveys, roosting activity was not confirmed.</p>
<p>Brown long-eared bat.</p>	<p>Relatively common and widespread nationally. Study Area is located within the known range for this species²⁵.</p> <p>The desk study returned one record relating to brown-long eared bat in flight within 15 km of the Site boundary.</p>	<p>Brown long-eared bat were recorded at six monitoring locations within the Study Area, accounting for 0.45% of total contacts.</p> <p>Data output from the Ecobat tools shows an overall low level of brown-long eared bat activity within the Study Area (Table 3.5 and Table 3.6). However, due to a lack of available records for this species within 100km of the Site for comparison (respective reference range of 117), the degree of confidence in these results is considered to be relatively low.</p>	<p>Roosting brown long-eared bats were not recorded in the Study Area.</p>

²⁴ Information relating to the distribution and range of Daubenton's bat in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1314-SC-Habitats-Directive-Art17-2019.pdf>

²⁵ Information relating to the distribution and range of brown long-eared bat in Scotland is available at: <https://jncc.gov.uk/jncc-assets/Art17/S1326-SC-Habitats-Directive-Art17-2019.pdf>

4.2 Potential Collision Risk Assessment

- 4.2.1 **Table 2.5** outlines the collision risk vulnerability of different bat species present in Scotland when considering the impact of wind farm developments. Survey results indicate that at least three to four bat species classified as 'high risk' of turbine collision have been confirmed to utilise the Study Area - these are common and soprano pipistrelle, and species of the genus *Nyctalus* (noctule and Leisler's bat).
- 4.2.2 At the time of writing, no infrastructure was proposed within at least 1 km of reference monitoring location L. For the purposes of assessing potential collision risk with turbine infrastructure, results relating to reference location L have therefore been excluded from the collision risk assessment.

Common pipistrelle

- 4.2.3 Results of the site-wide potential collision risk assessment for common pipistrelle show a median risk category score of 4, indicating that the overall collision risk for common pipistrelle is 'low' (**Table 3.7**). The maximum risk category score was 12, which suggests that the overall collision risk increases to 'medium' during nights of highest common pipistrelle activity.
- 4.2.4 The median and maximum risk category scores for monitoring locations A to K are detailed in **Table H.1 in Appendix H**. Based on median risk category scores, common pipistrelle is subject to a 'low' collision risk at seven monitoring locations (median risk category score of 4), and 'medium' collision risk at two monitoring locations (Location A in Summer and Autumn and location E in Autumn (median risk category score of 8). No contacts relating to common pipistrelle were recorded at the remaining two locations (locations C and G).

Soprano pipistrelle

- 4.2.5 Results of the site-wide potential collision risk assessment for soprano pipistrelle show a median risk category score of 12, indicating a 'medium' overall collision risk (**Table 3.7**). The maximum risk category score was 18, suggesting that the overall collision risk increases to 'high' during nights with greatest soprano pipistrelle activity.
- 4.2.6 Based on median risk category scores presented within collision risk data in **Appendix H**, monitoring locations that represent a 'high' overall collision risk to soprano pipistrelle are as follows:
- Location A during Summer; and
 - Location F during Autumn.

Pipistrellus species

- 4.2.7 Results of the site-wide²⁶ potential collision risk assessment for unidentified *Pipistrellus* species show a median risk category score of 8, indicating a 'medium' overall collision risk (**Table 3.7**). The maximum risk category score was 15, suggesting that the overall collision risk is 'high' during nights with greatest *Pipistrellus* species activity.
- 4.2.8 Based on median risk category scores in **Appendix H**, *Pipistrellus* species are subject to a 'low' collision risk at two monitoring locations (median risk category score of 4), and a 'medium' collision risk at six monitoring locations (median risk category score of 8 or 12).

²⁶ Excluding results for reference location L

No contacts relating to *Pipistrellus* species were recorded at the remaining three monitoring locations (locations C, G and J).

Nyctalus

- 4.2.9 Results of the site-wide potential collision risk assessment for *Nyctalus* species demonstrated a median risk category score of 15 and a maximum risk category score of 18, indicating that the overall collision risk for *Nyctalus* bat species within the Study Area is 'high' (**Table 3.7**).
- 4.2.10 Based on median risk category scores presented within collision risk data in **Appendix H**, monitoring locations that represent a 'high' overall collision risk to *Nyctalus* species are as follows:
- Location A during Autumn;
 - Location B during Autumn;
 - Location D during Autumn;
 - Location E during Autumn;
 - Location F during Autumn; and
 - Location H during Autumn.
- 4.2.11 These monitoring locations were positioned within the south-east of the Study Area in open upland habitat. The results suggest that *Nyctalus sp.* may utilise the open landscape and associated linear features (watercourses and coniferous woodland edge) as a commuting route during the transitional period of the active bat season prior to retreating to hibernation roosts over winter.
- 4.2.12 Based on location-specific collision risk assessment results, turbines that pose the greatest collision risk potential to 'high risk' bat species are: Turbine 1 during Summer and Autumn (monitoring location A); and Turbine 2 (monitoring location B), and Turbine 4 (monitoring location D), Turbine 5 (monitoring location E), and Turbine 6 (monitoring location F) during Autumn.

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Appendix A

Relevant legislation

All bat species in Scotland are afforded legal protection under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)²⁷. This makes it an offence to deliberately or recklessly:

- capture, injure or kill a wild bat;
- harass a wild bat or group of wild bats;
- disturb a wild bat in a roost (any structure or place which it uses for shelter or protection);
- disturb a wild bat while it is rearing or otherwise caring for its young;
- obstruct access to a bat roost or to otherwise deny the animal use of the roost;
- disturb a wild bat in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs; and
- disturb a wild bat in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young.

It is also an offence to:

- Damage or destroy a breeding site or resting place of such an animal (whether deliberately or recklessly); and
- Keep, transport, sell or exchange offer for sale or exchange any wild bat (or any part or a derivative of one) obtained after June 1994.

Any activity which is likely to affect bats requires consultation with the relevant statutory nature conservation organisation prior to any works commencing. In Scotland, this is NatureScot.

²⁷ The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) were amended by the Conservation (Natural Habitats, &c.) (EU Exit) (Scotland) (Amendment) Regulations 2019. The regulations as detailed above therefore remain in force following the UK's departure from the European Union.

Appendix B

Locations of Automated Detectors

Location	Latitude	Longitude	Habitat type(s)	Details
A	55.274733	-4.0824806	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, in open upland habitat of acid grassland.
B	55.267733	-4.0765577	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, in open upland habitat comprised of blanket bog.
C	55.281265	-4.0778311	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, approximately 130m west of a tributary of Pullmulloch Burn in open upland habitat.
D	55.277553	-4.0746929	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, approximately 125m east of Pulmulloch Burn.
E	55.271788	-4.0785954	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, in open upland habitat comprised of blanket bog.
F	55.273419	-4.0699118	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, in open upland habitat comprised of blanket bog. Positioned next to a historic drainage channel.
G	55.269375	-4.0672299	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, in open upland habitat comprised of blanket bog.
H	55.278749	-4.0656231	Open moorland, woodland edge	Automated detector positioned approximately 110m south-west of mature coniferous woodland edge, within open blanket bog habitat.
I	55.2863	-4.0708343	Open moorland	Automated detector positioned approximately 110m north-west of edge of coniferous woodland, within open upland habitat.
J	55.284349	-4.1437696	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground



				level on a wooden stake, in open upland habitat near summit of Alhang Hill.
K	55.291099	-4.1360537	Open moorland	Automated detector and microphone positioned approximately 1.3m above ground level on a wooden stake, in open upland habitat on the slope of Alwhat Hill.
L	55.28153	-4.0996378	Acid grassland, watercourse	Automated detector and microphone positioned approximately 1.3m above ground level on a fencepost located approximately 20m southwest of Lorg Burn.



Appendix C

Scientific Species Names

Common name	Scientific name
Brown long-eared bat	<i>Plecotus auritus</i>
Common pipistrelle	<i>Pipistrellus pipistrellus</i>
Daubenton's bat	<i>Myotis daubentonii</i>
Leisler's	<i>Nyctalus leisleri</i>
<i>Nathusius</i> pipistrelle	<i>Pipistrellus nathusii</i>
Noctule	<i>Nyctalus noctula</i>
<i>Nyctalus</i> bat species	<i>Nyctalus sp.</i>
<i>Myotis</i> bat species	<i>Myotis sp.</i>
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>
Whiskered bat	<i>Myotis mystacinus</i>

Appendix D

Assessing Potential Site Risk

Table D.1 Full details relating to Stage 1 – Initial site risk assessment

Site risk level (1-5)	Project size			
	Small	Medium	Large	
Habitat risk	Low	1	2	3
	Moderate	2	3	4
	High	3	4	5
Habitat risk	Description			
Low	<ul style="list-style-type: none"> Small number of potential roost features, of low quality. Low quality foraging habitat that could be used by small numbers of foraging bats. Isolated site not connected to the wider landscape by prominent linear features. 			
Moderate	<ul style="list-style-type: none"> Buildings, trees or other structures with moderate – high potential as roost sites on or near the site. Habitat could be used extensively for foraging bats. Site is connected to the wider landscape by linear features such as scrub, tree lines and streams. 			
High	<ul style="list-style-type: none"> Numerous suitable buildings, trees (particularly mature ancient woodland) or other structures with moderate-high potential as roost sites on or near the site, and/ or confirmed roosts present close to or on the site. Extensive and diverse habitat mosaic of high quality foraging for bats. Site is connected to the wider landscape by a network of strong linear features such as rivers, blocks of woodland and mature hedgerows. At/ near edge of range and/ or an important flyway. Close to key roost and/ or swarming site. 			
Project size	Description			
Small	<ul style="list-style-type: none"> Small scale development (≤ 10 turbines). No other wind energy developments within 10km. Comprising turbines <50m in height. 			
Medium	<ul style="list-style-type: none"> Larger developments (between 10 and 40 turbines). May have some other wind developments within 5km. Comprising turbines 50 – 100m in height. 			
Large	<ul style="list-style-type: none"> Largest developments (>40 turbines) with other wind energy developments within 5km. Comprising turbines >100m in height. 			

Appendix E

Environmental Conditions

Table E.1 Automated detector monitoring 2020 - survey periods and weather conditions

Monitoring period	Sunset	Sunrise	Min overnight temp (°C)	Max overnight temp (°C)	Min overnight wind speed (mph)	Max overnight wind speed (mph)	Daily Precipitation (mm)
06 – 07 May	21:03	05:22	4	9	0	5	
07 – 08 May	21:05	05:20	9	14	0	8	
08 – 09 May	21:07	05:18	10	12	0	2	
09 – 10 May	21:09	05:16	7	14	3	12	
10 – 11 May	21:11	05:15	0	5	0	8	
11 – 12 May	21:13	05:13	6	8	0	15	
12 – 13 May	21:14	05:11	4	7	6	10	
13 – 14 May	21:16	05:09	0	8	0	10	
14 – 15 May	21:18	05:07	4	10	0	15	
15 – 16 May	21:20	05:05	9	10	7	12	
16 – 17 May	21:22	05:04	10	11	7	13	
17 – 18 May	21:23	05:02	11	12	9	14	
18 – 19 May	21:25	05:00	12	13	0	9	
26 – 27 June	22:01	04:38	12	17	0	8	3.8
27 – 28 June	22:01	04:39	11	12	15	20	26.6
28 – 29 June	22:01	04:40	12	12	16	21	14.8
29 – 30 June	22:00	04:40	12	12	10	18	2
30 June – 01 July	22:00	04:41	13	13	2	3	2.8
01 – 02 July	22:00	04:42	11	13	2	9	8.6
02 – 03 July	21:59	04:43	10	13	5	6	12
03 – 04 July	21:58	04:44	12	12	0	2	6.6
04 – 05 July	21:58	04:45	12	16	15	26	9.8
05 – 06 July	21:57	04:46	11	12	12	20	10.2

Monitoring period	Sunset	Sunrise	Min overnight temp (°C)	Max overnight temp (°C)	Min overnight wind speed (mph)	Max overnight wind speed (mph)	Daily Precipitation (mm)
06 – 07 July	21:56	04:47	11	12	5	13	0
07 – 08 July	21:56	04:48	9	12	0	3	0
08 – 09 July	21:55	04:49	12	13	0	5	0.8
13 – 14 August	20:54	05:49	14	18	3	9	0
14 – 15 August	20:52	05:51	14	19	5	9	0
15 – 16 August	20:50	05:53	15	18	6	8	0
16 – 17 August	20:47	05:55	14	16	9	10	5.4
17 – 18 August	20:45	05:57	14	17	0	3	6
18 – 19 August	20:43	05:59	15	17	0	2	10.8
19 – 20 August	20:40	06:01	15	19	7	23	8.8
20 – 21 August	20:38	06:02	15	17	10	17	20.6
21 – 22 August	20:35	06:04	15	16	10	21	15.4
22- 23 August	20:33	06:06	14	15	6	14	5.2
23 – 24 August	20:31	06:08	9	14	0	7	2.8
24 – 25 August	20:28	06:10	11	13	0	13	10.6
25 – 26 August	20:26	06:12	14	15	3	13	21.6

Maximum and minimum overnight temperature and wind speeds obtained from:

<https://www.timeanddate.com/weather/@2653641/historic?month=5&year=2020>

Daily rainfall data obtained from the Scottish Environmental Protection Agency (SEPA) automated rain gauge at Craigdarroch (OS Grid Reference: NX 73942 90947) - located approximately 12km south-east of the Site:

<https://www2.sepa.org.uk/rainfall//data/index/115541>.

Appendix F

Activity Survey Results

Table F.1 Total contacts (average contacts per night) during Spring 2020

Location	No. of nights analysed	Total contacts (average per night)								
		CP	SP	CP/SP	NP/CP	N	<i>Nyctalus</i>	M	BLE	Total
A	13	1 (0.08)	1 (0.08)	1 (0.08)	0	0	0	0	0	3 (0.23)
B	13	0	0	0	0	0	0	0	0	0
C	13	0	0	0	0	0	0	0	0	0
D	13	0	0	0	0	0	0	1 (0.08)	0	1
E	13	0	0	0	0	0	1 (0.08)	8 (0.62)	0	9 (0.69)
F	13	1 (0.08)	0	1 (0.08)	0	0	0	0	0	2 (0.15)
G	13	0	0	0	0	0	0	1 (0.08)	0	1 (0.08)
H	13	0	0	0	0	0	0	0	0	0
I	13	0	0	0	0	0	0	0	0	0
J	13	0	0	0	0	0	0	0	0	0
K	13	1 (0.08)	0	0	0	0	0	0	0	1 (0.08)
L	0	-	-	-	-	-	-	-	-	-
Total	143	3 (0.02)	1 (0.01)	1 (0.01)	0 (0.00)	0 (0.00)	1 (0.01)	10 (0.07)	0 (0.00)	16 (0.11)
Proportion		18.75%	6.25%	6.25%	0.00%	0.00%	62.5%	62.5%	0.00%	





Table F.2 Total contacts (average contacts per night) during Summer 2020

Location	No. of nights analysed	Total contacts (average per night)								
		CP	SP	CP/SP	NP/CP	N	<i>Nyctalus</i>	M	BLE	Total
A	11	2 (0.18)	14 (1.27)	4 (0.36)	0	0	0	0	0	20 (1.82)
B	13	0	0	0	0	0	0	0	0	0
C	13	0	0	0	0	0	0	0	0	0
D	6	0	3 (0.50)	0	0	0	0	0	0	3 (0.50)
E	13	0	0	4 (0.31)	0	0	0	1 (0.08)	0	5 (0.38)
F	13	1 (0.08)	0	0	0	0	0	0	0	1 (0.08)
G	13	0	0	0	0	0	0	1 (0.08)	0	1 (0.08)
H	1	0	0	2 (2.00)	0	0	0	0	0	2 (2.00)
I	13	0	0	0	0	0	2 (0.15)	0	1 (0.08)	3 (0.23)
J	13	0	0	0	0	0	0	0	0	0
K	13	0	1 (0.08)	0	0	0	0	0	0	1 (0.08)
L	13	392 (30.15)	70 (5.38)	26 (2.00)	6 (0.46)	0	9 (0.69)	1 (0.08)	0	504 (38.77)
Total	124	395 (2.93)	88 (0.65)	36 (0.27)	6 (0.04)	0 (0.00)	11 (0.08)	3 (0.02)	1 (0.01)	540 (4.00)
Proportion		73.15%	16.30%	6.67%	1.11%	0.00%	2.04%	0.56%	0.19%	



Table F.3 Total contacts (average contacts per night) during Autumn 2020

Location	No. of nights analysed	Total contacts (average per night)								
		CP	SP	CP/SP	NP/CP	N	<i>Nyctalus</i>	M	BLE	Total
A	13	2 (0.15)	21 (1.62)	13 (1.00)	0	65 (5.00)	58 (4.46)	0	1 (0.08)	160 (12.31)
B	13	3 (0.23)	20 (1.54)	14 (1.08)	0	81 (6.23)	86 (6.62)	3 (0.23)	0	207 (15.92)
C	13	0	0	0	0	0	0	0	0	0
D	13	7 (0.54)	21 (1.62)	6 (0.46)	1 (0.08)	68 (5.23)	44 (3.38)	17 (1.31)	1 (0.08)	165 (12.69)
E	13	13 (1.00)	28 (2.15)	18 (1.38)	0	66 (5.08)	78 (6.00)	1 (0.08)	3 (0.23)	207 (15.92)
F	13	10 (0.77)	26 (2.00)	17 (1.31)	0	44 (3.38)	68 (5.23)	7 (0.54)	3 (0.23)	175 (13.46)
G	13	0	0	0	0	0	0	0	0	0 (0.00)
H	13	8 (0.62)	8 (0.62)	2 (0.15)	0	21 (1.62)	18 (1.38)	0	0	57 (4.38)
I	13	4 (0.31)	7 (0.54)	8 (0.62)	0	47 (3.62)	20 (1.54)	1 (0.08)	1 (0.08)	88 (6.77)
J	13	2 (0.15)	1 (0.08)	0	0	8 (0.62)	12 (0.92)	2 (0.23)	0	26 (2.00)
K	6	5 (0.83)	12 (2.00)	10 (1.67)	0	25 (4.17)	11 (1.83)	2 (0.33)	0	65 (10.83)
L	13	249 (19.15)	129 (9.92)	771 (59.31)	0	4 (0.31)	37 (2.85)	7 (0.54)	3 (0.23)	1200 (92.31)
Total	149	303 (2.03)	273 (1.83)	859 (5.77)	1 (0.01)	429 (2.88)	432 (2.90)	41 (0.28)	12 (0.08)	2350 (15.77)
Proportion		12.89%	11.62%	36.55%	0.04%	18.26%	18.38%	1.74%	0.51%	

Appendix G

Ecobat Results

Site-wide results

Table G.1 Number of nights that recorded bat activity fell into each activity band for each species at monitoring locations A to K

Species/ species group	Nights of high activity	Nights of moderate/ high activity	Nights of moderate activity	Nights of low/ moderate activity	Nights of low activity
CP	0	1	5	9	23
SP	1	12	12	7	17
<i>Pipistrellus*</i>	0	5	7	15	15
M	0	2	4	1	13
<i>Nyctalus</i>	24	23	9	4	13
BLE**	0	0	0	1	8

Note that number of nights can exceed total recording length as multiple instances can be generated if bat activity was detected on multiple detectors during the same nights recording.

* Includes contacts relating to both CP/ SP and CP/NP.

** Due to a lack of available records within 100km of the Site for this species for comparison there is a low degree of confidence in these results.

Per location results

Table G.2 Summary table showing key metrics for each species recorded.

Automated detector ID	Species/ species group	Median percentile	95% CIs	Max percentile	Nights recorded	Reference range*
A	<i>Nyctalus</i>	75	31 - 85	91	10	1921
A	<i>Pipistrellus</i>	31	16 - 54	64	6	3976
A	<i>Pipistrellus pipistrellus</i>	31	31 - 31	31	3	2933
A	<i>Pipistrellus pygmaeus</i>	54	27.5 - 67.5	81	8	3170
A	<i>Plecotus auritus</i>	1	0	1	1	117
B	<i>Myotis</i>	46	0	46	1	1123
B	<i>Nyctalus</i>	71	36 - 85.5	93	11	1921
B	<i>Pipistrellus</i>	16	1 - 34.5	68	6	3976
B	<i>Pipistrellus pipistrellus</i>	1	1 - 1	1	3	2933
B	<i>Pipistrellus pygmaeus</i>	60	30.5 - 60	60	5	3170

Automated detector ID	Species/ species group	Median percentile	95% CIs	Max percentile	Nights recorded	Reference range*
D	<i>Myotis</i>	1	1 - 39	77	6	1123
D	<i>Nyctalus</i>	86	65 - 89.5	92	6	1921
D	<i>Pipistrellus</i>	16	1 - 31	46	4	3976
D	<i>Pipistrellus pipistrellus</i>	16	1 - 31	46	4	2933
D	<i>Pipistrellus pygmaeus</i>	46	1 - 73	73	5	3170
D	<i>Plecotus auritus</i>	1	0	1	1	117
E	<i>Myotis</i>	1	1 - 1	71	3	1123
E	<i>Nyctalus</i>	84	43 - 87	89	10	1921
E	<i>Pipistrellus</i>	46	16 - 57	68	7	3976
E	<i>Pipistrellus pipistrellus</i>	31	16 - 46	46	6	2933
E	<i>Pipistrellus pygmaeus</i>	60	1 - 66.5	73	7	3170
E	<i>Plecotus auritus</i>	16	16 - 16	31	2	117
F	<i>Myotis</i>	46	46 - 46	46	3	1123
F	<i>Nyctalus</i>	75	51 - 83.5	89	10	1921
F	<i>Pipistrellus</i>	31	1 - 47.5	64	7	3976
F	<i>Pipistrellus pipistrellus</i>	1	1 - 23.5	46	8	2933
F	<i>Pipistrellus pygmaeus</i>	54	16 - 62	64	7	3170
F	<i>Plecotus auritus</i>	1	1 - 1	1	3	117
G	<i>Myotis</i>	1	1 - 1	1	2	1123
H	<i>Nyctalus</i>	62	30.5 - 73.5	83	6	1921
H	<i>Pipistrellus</i>	1	1 - 1	31	3	3976
H	<i>Pipistrellus pipistrellus</i>	1	1 - 1	60	4	2933
H	<i>Pipistrellus pygmaeus</i>	1	1 - 23.5	46	5	3170
I	<i>Myotis</i>	1	0	1	1	1123
I	<i>Nyctalus</i>	46	1 - 78	85	10	1921
I	<i>Pipistrellus</i>	31	16 - 38.5	46	4	3976
I	<i>Pipistrellus pipistrellus</i>	1	1 - 1	31	4	2933
I	<i>Pipistrellus pygmaeus</i>	1	1 - 16	31	5	3170
I	<i>Plecotus auritus</i>	1	1 - 1	1	2	117
J	<i>Myotis</i>	16	16 - 16	31	2	1123

Automated detector ID	Species/ species group	Median percentile	95% CIs	Max percentile	Nights recorded	Reference range*
J	<i>Nyctalus</i>	59	1 - 73	73	4	1921
J	<i>Pipistrellus pipistrellus</i>	1	1 - 1	1	2	2933
J	<i>Pipistrellus pygmaeus</i>	1	0	1	1	3170
K	<i>Myotis</i>	1	1 - 1	1	2	1123
K	<i>Nyctalus</i>	59	27.5 - 75	77	6	1921
K	<i>Pipistrellus</i>	31	16 - 38.5	46	5	3976
K	<i>Pipistrellus pipistrellus</i>	1	1 - 1	46	4	2933
K	<i>Pipistrellus pygmaeus</i>	16	1 - 42.5	54	6	3170
L	<i>Myotis</i>	30	30 - 30	30	5	998
L	<i>Nyctalus</i>	45	44.5 - 62	79	14	1863
L	<i>Pipistrellus</i>	59	53 - 85	98	19	3710
L	<i>Pipistrellus pipistrellus</i>	83	74.5 - 89.5	97	23	2805
L	<i>Pipistrellus pygmaeus</i>	67	56 - 80	91	21	3042
L	<i>Plecotus auritus</i>	0	0 - 0	0	3	88

*The reference range is the number of nights for each species that the data is compared to. A reference range of 200+ is recommended to be confident in the relative activity level.

Table G.3 Summary table showing the number of nights recorded bat activity fell into each activity band for each species during each month of monitoring

Monitoring location ID	Species/ species group	Month*	Nights of high activity	Nights of moderate/ high activity	Nights of moderate activity	Nights of low/ moderate activity	Nights of low activity
A	<i>Nyctalus</i>	Aug	4	2	1	1	2
A	<i>Pipistrellus</i>	Jun	0	0	1	0	0
A	<i>Pipistrellus</i>	Aug	0	1	0	3	1
A	<i>Pipistrellus pipistrellus</i>	May	0	0	0	0	1
A	<i>Pipistrellus pipistrellus</i>	Jun	0	0	0	1	0
A	<i>Pipistrellus pipistrellus</i>	Aug	0	0	0	1	0
A	<i>Pipistrellus pygmaeus</i>	May	0	0	0	0	1
A	<i>Pipistrellus pygmaeus</i>	Jun	1	0	0	0	0

Monitoring location ID	Species/ species group	Month*	Nights of high activity	Nights of moderate/ high activity	Nights of moderate activity	Nights of low/ moderate activity	Nights of low activity
A	<i>Pipistrellus pygmaeus</i>	Aug	0	1	3	2	0
A	<i>Plecotus auritus</i>	Aug	0	0	0	0	1
B	<i>Myotis</i>	Aug	0	0	1	0	0
B	<i>Nyctalus</i>	Aug	4	3	1	0	3
B	<i>Pipistrellus</i>	Aug	0	1	0	2	3
B	<i>Pipistrellus pipistrellus</i>	Aug	0	0	0	0	3
B	<i>Pipistrellus pygmaeus</i>	Aug	0	3	1	0	1
D	<i>Myotis</i>	May	0	0	0	0	1
D	<i>Myotis</i>	Aug	0	1	1	0	3
D	<i>Nyctalus</i>	Aug	4	1	1	0	0
D	<i>Pipistrellus</i>	Aug	0	0	1	1	2
D	<i>Pipistrellus pipistrellus</i>	Aug	0	0	1	1	2
D	<i>Pipistrellus pygmaeus</i>	Jun	0	0	1	0	0
D	<i>Pipistrellus pygmaeus</i>	Aug	0	2	1	0	1
D	<i>Plecotus auritus</i>	Aug	0	0	0	0	1
E	<i>Myotis</i>	May	0	1	0	0	0
E	<i>Myotis</i>	Jun	0	0	0	0	1
E	<i>Myotis</i>	Aug	0	0	0	0	1
E	<i>Nyctalus</i>	May	0	0	0	0	1
E	<i>Nyctalus</i>	Aug	6	2	0	1	0
E	<i>Pipistrellus</i>	Jun	0	0	1	0	0
E	<i>Pipistrellus</i>	Aug	0	1	2	1	2
E	<i>Pipistrellus pipistrellus</i>	Aug	0	0	2	3	1
E	<i>Pipistrellus pygmaeus</i>	Aug	0	4	0	0	3
E	<i>Plecotus auritus</i>	Aug	0	0	0	1	1
F	<i>Myotis</i>	Aug	0	0	2	0	1

Monitoring location ID	Species/ species group	Month*	Nights of high activity	Nights of moderate/ high activity	Nights of moderate activity	Nights of low/ moderate activity	Nights of low activity
F	<i>Nyctalus</i>	Aug	3	4	2	1	0
F	<i>Pipistrellus</i>	May	0	0	0	0	1
F	<i>Pipistrellus</i>	Aug	0	2	0	2	2
F	<i>Pipistrellus pipistrellus</i>	May	0	0	0	0	1
F	<i>Pipistrellus pipistrellus</i>	Jun	0	0	0	0	1
F	<i>Pipistrellus pipistrellus</i>	Aug	0	0	1	2	3
F	<i>Pipistrellus pygmaeus</i>	Aug	0	2	3	1	1
F	<i>Plecotus auritus</i>	Aug	0	0	0	0	3
G	<i>Myotis</i>	May	0	0	0	0	1
G	<i>Myotis</i>	Jun	0	0	0	0	1
H	<i>Nyctalus</i>	Aug	1	3	1	0	1
H	<i>Pipistrellus</i>	Jun	0	0	0	1	0
H	<i>Pipistrellus</i>	Aug	0	0	0	0	2
H	<i>Pipistrellus pipistrellus</i>	Aug	0	1	0	0	3
H	<i>Pipistrellus pygmaeus</i>	Aug	0	0	1	1	3
I	<i>Myotis</i>	Aug	0	0	0	0	1
I	<i>Nyctalus</i>	Jun	0	0	0	0	1
I	<i>Nyctalus</i>	Jul	0	0	0	0	1
I	<i>Nyctalus</i>	Aug	2	3	0	1	2
I	<i>Pipistrellus</i>	Aug	0	0	1	2	1
I	<i>Pipistrellus pipistrellus</i>	Jun	0	0	0	0	1
I	<i>Pipistrellus pipistrellus</i>	Aug	0	0	0	1	2
I	<i>Pipistrellus pygmaeus</i>	Aug	0	0	0	2	3
I	<i>Plecotus auritus</i>	Jun	0	0	0	0	1
I	<i>Plecotus auritus</i>	Aug	0	0	0	0	1

Monitoring location ID	Species/ species group	Month*	Nights of high activity	Nights of moderate/ high activity	Nights of moderate activity	Nights of low/ moderate activity	Nights of low activity
J	<i>Myotis</i>	Aug	0	0	0	1	1
J	<i>Nyctalus</i>	Aug	0	2	1	0	1
J	<i>Pipistrellus pipistrellus</i>	Aug	0	0	0	0	2
J	<i>Pipistrellus pygmaeus</i>	Aug	0	0	0	0	1
K	<i>Myotis</i>	Aug	0	0	0	0	2
K	<i>Nyctalus</i>	Aug	0	3	2	0	1
K	<i>Pipistrellus</i>	Aug	0	0	1	3	1
K	<i>Pipistrellus pipistrellus</i>	May	0	0	0	0	1
K	<i>Pipistrellus pipistrellus</i>	Aug	0	0	1	0	2
K	<i>Pipistrellus pygmaeus</i>	Jul	0	0	0	0	1
K	<i>Pipistrellus pygmaeus</i>	Aug	0	0	2	1	2
L	<i>Myotis</i>	Jun	0	0	0	0	1
L	<i>Myotis</i>	Aug	0	0	0	3	1
L	<i>Nyctalus</i>	Jun	0	0	2	1	0
L	<i>Nyctalus</i>	Jul	0	0	0	0	1
L	<i>Nyctalus</i>	Aug	0	1	6	0	3
L	<i>Pipistrellus</i>	Jun	1	1	0	0	0
L	<i>Pipistrellus</i>	Jul	0	0	1	2	1
L	<i>Pipistrellus</i>	Aug	6	1	3	1	2
L	<i>Pipistrellus pipistrellus</i>	Jun	3	0	0	0	0
L	<i>Pipistrellus pipistrellus</i>	Jul	5	1	0	0	1
L	<i>Pipistrellus pipistrellus</i>	Aug	6	2	1	2	2
L	<i>Pipistrellus pygmaeus</i>	Jun	2	0	1	0	0
L	<i>Pipistrellus pygmaeus</i>	Jul	0	2	1	0	3

Monitoring location ID	Species/ species group	Month*	Nights of high activity	Nights of moderate/ high activity	Nights of moderate activity	Nights of low/ moderate activity	Nights of low activity
L	<i>Pipistrellus pygmaeus</i>	Aug	4	3	1	3	1
L	<i>Plecotus auritus</i>	Aug	0	0	0	0	3



Appendix H

Location Specific Risk Assessment Results

Table H.1 Location specific risk assessment scores for 'high collision risk' species recorded within the Study Area (excluding reference location L)

Automated detector ID	Species/ species group	Month	Median percentile	Median activity category	Max percentile	Max activity category	Initial site risk score	Median risk score	Median risk category	Maximum risk score	Maximum risk category
A	<i>Nyctalus</i>	Aug	75	Moderate - High	91	High	4	15	High	18	High
A	<i>Pipistrellus</i>	Jun	54	Moderate	54	Moderate	4	12	Medium	12	Medium
A	<i>Pipistrellus</i>	Aug	31	Low - moderate	64	Moderate - High	4	8	Medium	15	High
A	<i>Pipistrellus pipistrellus</i>	May	1	Low	1	Low	4	4	Low	4	Low
A	<i>Pipistrellus pipistrellus</i>	Jun	31	Low - moderate	31	Low - moderate	4	8	Medium	8	Medium
A	<i>Pipistrellus pipistrellus</i>	Aug	31	Low - moderate	31	Low - moderate	4	8	Medium	8	Medium
A	<i>Pipistrellus pygmaeus</i>	May	1	Low	1	Low	4	4	Low	4	Low
A	<i>Pipistrellus pygmaeus</i>	Jun	81	High	81	High	4	18	High	18	High
A	<i>Pipistrellus pygmaeus</i>	Aug	54	Moderate	60	Moderate	4	12	Medium	12	Medium
B	<i>Nyctalus</i>	Aug	71	Moderate - High	93	High	4	15	High	18	High
B	<i>Pipistrellus</i>	Aug	16	Low	68	Moderate - High	4	4	Low	15	High

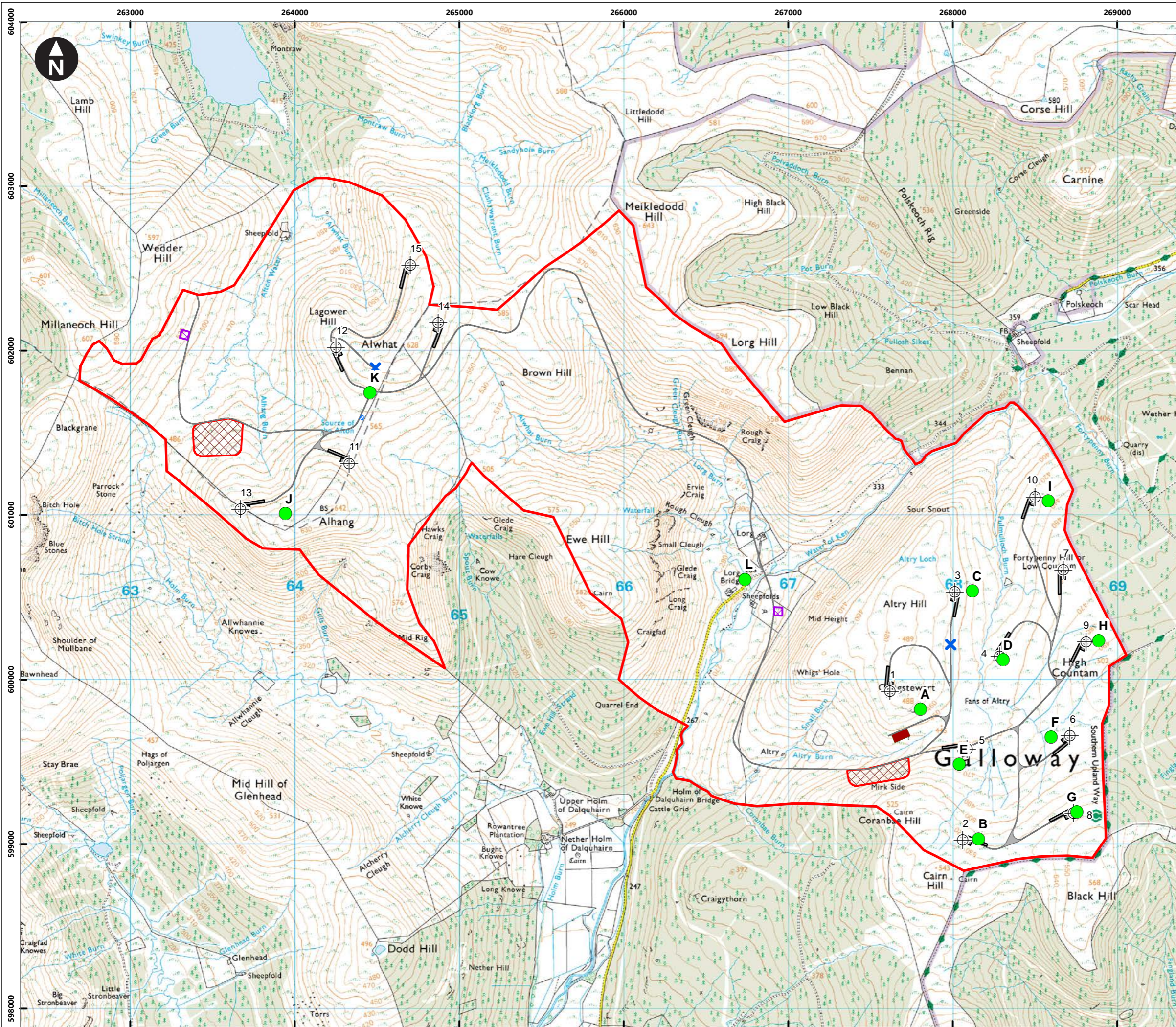
Automated detector ID	Species/ species group	Month	Median percentile	Median activity category	Max percentile	Max activity category	Initial site risk score	Median risk score	Median risk category	Maximum risk score	Maximum risk category
B	<i>Pipistrellus pipistrellus</i>	Aug	1	Low	1	Low	4	4	Low	4	Low
B	<i>Pipistrellus pygmaeus</i>	Aug	60	Moderate	60	Moderate	4	12	Medium	12	Medium
D	<i>Nyctalus</i>	Aug	86	High	92	High	4	18	High	18	High
D	<i>Pipistrellus</i>	Aug	16	Low	46	Moderate	4	4	Low	12	Medium
D	<i>Pipistrellus pipistrellus</i>	Aug	16	Low	46	Moderate	4	4	Low	12	Medium
D	<i>Pipistrellus pygmaeus</i>	Jun	46	Moderate	46	Moderate	4	12	Medium	12	Medium
D	<i>Pipistrellus pygmaeus</i>	Aug	59	Moderate	73	Moderate - High	4	12	Medium	15	High
E	<i>Nyctalus</i>	May	1	Low	1	Low	4	4	Low	4	Low
E	<i>Nyctalus</i>	Aug	85	High	89	High	4	18	High	18	High
E	<i>Pipistrellus</i>	Jun	54	Moderate	54	Moderate	4	12	Medium	12	Medium
E	<i>Pipistrellus</i>	Aug	39	Low - moderate	68	Moderate - High	4	8	Medium	15	High
E	<i>Pipistrellus pipistrellus</i>	Aug	31	Low - moderate	46	Moderate	4	8	Medium	12	Medium

Automated detector ID	Species/ species group	Month	Median percentile	Median activity category	Max percentile	Max activity category	Initial site risk score	Median risk score	Median risk category	Maximum risk score	Maximum risk category
E	<i>Pipistrellus pygmaeus</i>	Aug	60	Moderate	73	Moderate - High	4	12	Medium	15	High
F	<i>Nyctalus</i>	Aug	75	Moderate - High	89	High	4	15	High	18	High
F	<i>Pipistrellus</i>	May	1	Low	1	Low	4	4	Low	4	Low
F	<i>Pipistrellus</i>	Aug	31	Low - moderate	64	Moderate - High	4	8	Medium	15	High
F	<i>Pipistrellus pipistrellus</i>	May	1	Low	1	Low	4	4	Low	4	Low
F	<i>Pipistrellus pipistrellus</i>	Jun	1	Low	1	Low	4	4	Low	4	Low
F	<i>Pipistrellus pipistrellus</i>	Aug	16	Low	46	Moderate	4	4	Low	12	Medium
F	<i>Pipistrellus pygmaeus</i>	Aug	54	Moderate - High	64	Moderate - High	4	15	High	15	High
H	<i>Nyctalus</i>	Aug	62	Moderate - High	83	Moderate - High	4	15	High	15	High
H	<i>Pipistrellus</i>	Jun	31	Low - moderate	31	Low - moderate	4	8	Medium	8	Medium
H	<i>Pipistrellus</i>	Aug	1	Low	1	Low	4	4	Low	4	Low
H	<i>Pipistrellus pipistrellus</i>	Aug	1	Low	60	Moderate	4	4	Low	12	Medium

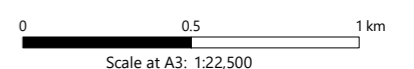
Automated detector ID	Species/ species group	Month	Median percentile	Median activity category	Max percentile	Max activity category	Initial site risk score	Median risk score	Median risk category	Maximum risk score	Maximum risk category
H	<i>Pipistrellus pygmaeus</i>	Aug	1	Low	46	Moderate	4	4	Low	12	Medium
I	<i>Nyctalus</i>	Jun	1	Low	1	Low	4	4	Low	4	Low
I	<i>Nyctalus</i>	Jul	1	Low	1	Low	4	4	Low	4	Low
I	<i>Nyctalus</i>	Aug	68	Moderate - High	85	High	4	4	Low	18	High
I	<i>Pipistrellus</i>	Aug	31	Low - moderate	46	Moderate	4	8	Medium	12	Medium
I	<i>Pipistrellus pipistrellus</i>	Jun	1	Low	1	Low	4	4	Low	4	Low
I	<i>Pipistrellus pipistrellus</i>	Aug	1	Low	31	Low - moderate	4	4	Low	8	Medium
I	<i>Pipistrellus pygmaeus</i>	Aug	1	Low	31	Low - moderate	4	4	Low	8	Medium
J	<i>Nyctalus</i>	Aug	59	Moderate	73	Moderate - High	4	12	Medium	15	High
J	<i>Pipistrellus pipistrellus</i>	Aug	1	Low	1	Low	4	4	Low	4	Low
J	<i>Pipistrellus pygmaeus</i>	Aug	1	Low	1	Low	4	4	Low	4	Low
K	<i>Nyctalus</i>	Aug	59	Moderate	77	Moderate - High	4	12	Medium	15	High
K	<i>Pipistrellus</i>	Aug	31	Low - moderate	46	Moderate	4	8	Medium	12	Medium

Automated detector ID	Species/ species group	Month	Median percentile	Median activity category	Max percentile	Max activity category	Initial site risk score	Median risk score	Median risk category	Maximum risk score	Maximum risk category
K	<i>Pipistrellus pipistrellus</i>	May	1	Low	1	Low	4	4	Low	4	Low
K	<i>Pipistrellus pipistrellus</i>	Aug	1	Low	46	Moderate	4	4	Low	12	Medium
K	<i>Pipistrellus pygmaeus</i>	Jul	1	Low	1	Low	4	4	Low	4	Low
K	<i>Pipistrellus pygmaeus</i>	Aug	31	Low - moderate	54	Moderate	4	8	Medium	12	Medium

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- Key
- Site boundary
 - + Turbine location
 - x Met mast location
 - Western control building
 - Temporary compound
 - Crane pads
 - Access tracks
 - Substation
 - Borrow pit search area
 - Automated detector units



Based upon the Ordnance Survey Map with the permission of the Controller of Her Majesty's Stationary Office.
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Long Wind Farm
Technical Appendix 11.D
Bat Survey Report

Figure 2.1
Study area and automated detector location map